Oxidation Resistant, Cr retaining, Conductive Coatings on Metallic Alloys for SOFC Interconnects

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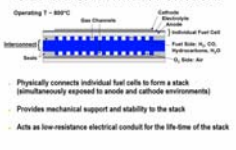
Arcomac Surface Engineering, LLC[a], in collaboration with Montana State University[b], sponsored by the Solid Energy Conversion Alliance (SECA) Core Technology Program

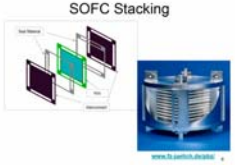
SOFC Metallic Interconnects

- Promise
  - Lower operating temperatures (600-800C) may allow inexpensive metallic alloys for SOFC interconnects
- Challenge
  - Conventional metallic alloys develop protective oxide scales during SOFC exposure, degrading performance

SOFC Interconnect Function:

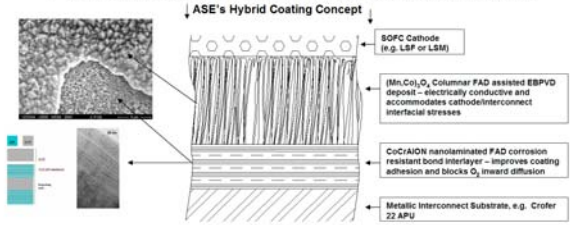


SOFC Stacking

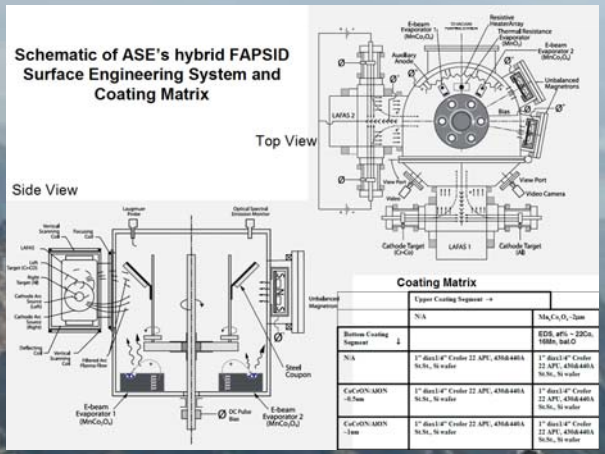


Arcomac's Technical Approach

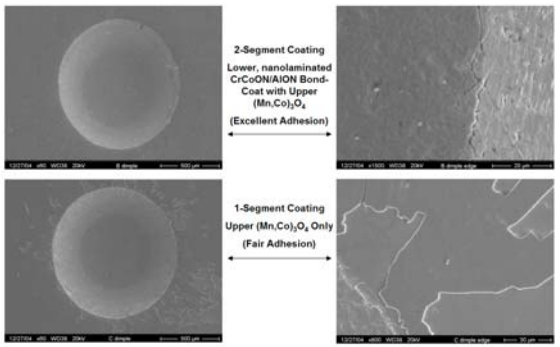
- 2-Segment Coating Concept:
  - 1st Segment – nanolaminated CrCoON/AlON (oxidation resistant diffusion barrier, bond coating)
  - 2nd Segment – columnar grain $(Mn,Co)_3O_4$ (electrically conductive, Cr-retaining spinel)
- Hybrid Surface Engineering Techniques
  - Coating deposition process combines conventional and advanced evaporation and ionization sources (filtered arc deposition (FAD) and filtered arc-assisted e-beam evaporation physical vapor deposition (FAD-assisted EBPVD))
- Simulated Performance Evaluation
  - Testing for SOFC compatibility: HT oxidation; electrical conductivity; and prototypical performance



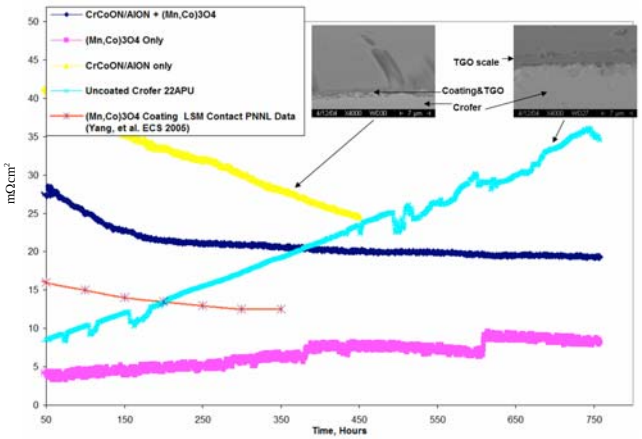
Schematic of ASE's hybrid FAPSID Surface Engineering System and Coating Matrix



Coating Adhesion Assessment - Rockwell Indentations



Preliminary ASR Results of Coated and Uncoated Crofer 22APU with Ag Paste Contact



Future Work

- Optimize Coating Architecture and Composition to Meet or Exceed SECA SOFC Interconnect Cost and Performance Requirements
- Expand Testing and Analyses to more Prototypical SOFC Exposure
- Assess Coating Process Scale-Up, Economics and Technology Transfer to SECA Industrial Teams